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SOIL-BORNE PATHOGEN SURVEY OF TWO NURSERIES IN MICHIGAN

by

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INTRODUCTION

Mortality of white and red pine seedlings at the Wyman State Forest Nursery in Manistique, Michigan, and southern Michigan State Forest Nursery in Howell, Michigan, has been reported during the last two years. As part of an overall evaluation in the two nurseries, soil samples were examined to determine if the following pathogenic species of fungi were present: Pythium, Fusarium, Cylindrocladium, Rhizoctonia, and Sclerotium. This preliminary evaluation was designed to indicate where potential problems currently exist within the nurseries and to provide background information should disease problems develop in the future.

MATERIALS AND METHODS

Soil samples were collected by personnel at each nursery. Three samples (each a composite of five samples collected with a standard 1-inch soil auger) were collected from each block, placed in an ice chest, and sent to the St. Paul Field Office for pathogen analysis.

A dilution-plate technique was used to isolate Pythium, Fusarium, Cylindrocladium, and Rhizoctonia from the soil. For each sample, 20 g (fresh weight) of soil was suspended in 200 ml of 0.3 percent water agar. One ml of this 1:10 dilution was plated on each of three plates of rose bengal agar (Hendrix and Kuhlman 1965) and incubated for 2 days in the dark at room temperature. Serial transfers from the 1:10 soil suspension to sterile water blanks were then made, resulting in 1:500 and 1:1000 dilutions. One ml of each dilution was plated on each of three replicates of PCNB agar (Nash and Snyder 1962) and incubated for 4 days at room temperature. Resulting colonies thought to be species of Pythium on rose bengal agar or Fusarium, Cylindrocladium, or Rhizoctonia on PCNB agar were counted and then transferred to pure culture for later identification. The number of fungal propagules per gram of air-dried soil was calculated following adjustments for moisture content of soil samples.

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The screening for Sclerotium was done by washing 20 g of soil from each sample through a series of 20, 30, 40, and 60 mesh sieves. For all samples, particles retained on the 40-mesh sieve were examined under a dissecting scope (30 x) for the presence of characteristic sclerotia. Residues on the 30- and 60-mesh sieves of every third sample were also examined.

RESULTS

No colonies of Pythium were found on the rose bengal agar and no sclerotia were found during soil sieving. Neither Cylindrocladium nor Rhizoctonia was isolated on PCNB agar. The following four species of Fusarium were isolated: F. solani, F. oxysporum, F. roseum var. equiseti, and an unidentified variety of F. roseum. These species were identified by Carol Windels, pathologist, University of Minnesota. Counts ranged from 0 to 5.6×10^4 propagules/g soil.

DISCUSSION

The incidence of soil-borne pathogens is usually expressed as propagules (for example, fungal reproductive structures such as spores) per gram of soil. Hazard levels (in propagules/g soil) for root rot caused by Fusarium are: low; less than 1000; moderate; 1,000 to 3,000; high; 3,000 + (Thor Kommedahl, Univ. of Minn., personal communication). Fusarium oxysporum is the only species of the four found which has been reported to cause root disease of conifer seedlings (Hepting 1971; Peterson and Smith 1975). Populations of this species in the high hazard range were found in the following areas:

Nursery	Block	Section	Crop
Wyman	II	1	cover crop
Wyman	IV	3	1-0 white pine
Wyman	V	3	cover crop
Southern Mich.	9	C	cover crop

F. oxysporum was found at moderate levels at Wyman nursery in block III, section four and block VIII, section six. These are preliminary results and more investigation is needed, but they indicate possible problem areas.

RECOMMENDATIONS

Pathogenicity of species of Fusarium varies by isolate host, and environment and it is not known if the isolates of F. oxysporum found at these nurseries are pathogenic to pine seedlings. However, four alternatives can be suggested for nursery beds with potentially high risks of root rot due to Fusarium:

1. Do not use infected areas.
2. Use methyl bromide as a soil fumigant.
3. Use captan preseeding soil treatment.
4. Alter fertilization -- especially reducing or eliminating nitrogen for the susceptible period.

The second alternative,if implemented properly, will eliminate the pathogens; the third will reduce population levels; and the fourth will reduce the effectiveness of the pathogens which are present. Seedlings are most susceptible to infection in their first year, especially during the first month of growth. Excessive fertilization or other practices which enhance succulent growth or decrease the rate of hardening-off of root tissues increase the chance of infection.

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PESTICIDE PRECAUTIONARY STATEMENTs

The pesticides reported on and recommended here were registered for the use described at the time this manuscript was prepared. Since the registration of pesticides is under constant review by State and Federal authorities, a responsible State agency should be consulted as to the current status of this pesticide.

Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife--if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.